



### C16 Microscopical Analysis of Dusts From Disasters: Natural and Manmade

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After attending this presentation, attendees will have an understanding of how the microscopical analysis of dust particles can be used to determine the source of contamination caused by mass disasters: natural and man-made.

This presentation will impact the forensic community and/or humanity by showing the audience that the forensic investigation of trace evidence using various types of microscopes is being extended into the broader fields of engineering and environmental investigations. Decisions involving millions of dollars and potential health risk assessments are being made on the basis of forensic microscopical techniques.

Microscopical analyses are used to characterize the dust particles from natural disasters such as volcanic eruptions, forest fires, and wind storms as well as man-made catastrophic events such as building fires, building demolitions, and terrorist attacks such as the 2001 attack on the World Trade Center (WTC) buildings in New York City. Analysis of dust particles can be used to delineate the effective range of impact from mass disasters: natural and man-made. A number of different types of instruments including polarized light microscopy, scanning, and transmission electron microscopy, and FTIR (infrared) microscopy are used to characterize the dust. In some cases the microscopical characteristics of the dust particles can be used to determine a dust signature. Based on thousands of analysis of residential and office dusts, most normal building dusts can be described using a combination of approximately 20 different particle types. These particle types include: skin cells, pollen, fungal material, soil minerals, soot, flyash, synthetic fibers, glass fibers, plant fragments, hair, wool fibers, cotton fibers, paper fragments, ink/photocopy, paint, construction debris, insect parts, starch, aerosol particles, rubber, and rust/metal flakes. A microscopical study of the general composition of household dust involving 72 samples from 7 different geographic regions within the United States showed that the most common components in household dust were skin cells, soil minerals, plant fragments, hair, cotton fibers, and starch grains.

The dust that was disseminated during the man-made mass disaster of the destruction of the World Trade Center of September 11, 2005 has been extensively studied. It differs from the average household dust in that it contains high amounts of glass fibers, gypsum and cement. [Analyses have shown it to contain: glass fibers (primarily mineral wool) - 35 – 40 %, gypsum particles - 25 – 30 %, cement/calcium-containing particles - 10 – 15 %, cellulose (paper, cotton, wood fibers) - 5 – 10 %, combustion products (soot and char) - 1 – 10 %, crystalline silica ~ 6 %, asbestos (primarily chrysotile with some amosite and tremolitic) - < 1 – 2 %, other material classes (paint, metal, vermiculite, glass shards) <1 % per class]. The U.S. Environmental Protection Agency studied the question of a set of “signature markers” of WTC dust in their effort to identify residual WTC dust contamination in hundreds of residential and office units around Ground Zero. The Agency initially proposed using 3 markers: mineral slag wool, gypsum and elements of concrete. MVA Scientific Consultants was one of the laboratories that participated in the WTC Dust Screening Study of the proposed “Signature” analysis method. Based on the results of the study group, EPA concluded that gypsum and elements consistent with concrete did not meet the WTC signature selection criteria and proposed slag wool as a signature constituent of WTC dust. However, after studying EPA’s “Final Report on the World Trade Center Dust Screening Study,” an independent peer review group concluded, “the proposed method has not demonstrated the utility of slag wool as a successful signature constituent.” Thus, at this time, no method of determining “WTC Signature Markers” has been accepted by the scientific community. It would appear that the \$200 million plus demolition of a building in Manhattan based on a forensic dust examination allegedly showing contamination with WTC dust was not based on sound scientific judgment.

#### Microscopy, Particle Analysis, Dust